





SCIENCE

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Name :

Class :

4th PRIMARY Second Term

THEME THREE:

PROTECTING OUR PLANET

UNIT THREE:

ENERGY AND FUEL



Unit 3 concept 1

Devices and energy

Energy

It is the ability to do work.

forms of energy :

(heat energy, Light energy Chemical energy).

Devices and energy

energy Transform from one form To another

ex:-electric energy change into

sound energy | **light energy** | **kinetic energy**



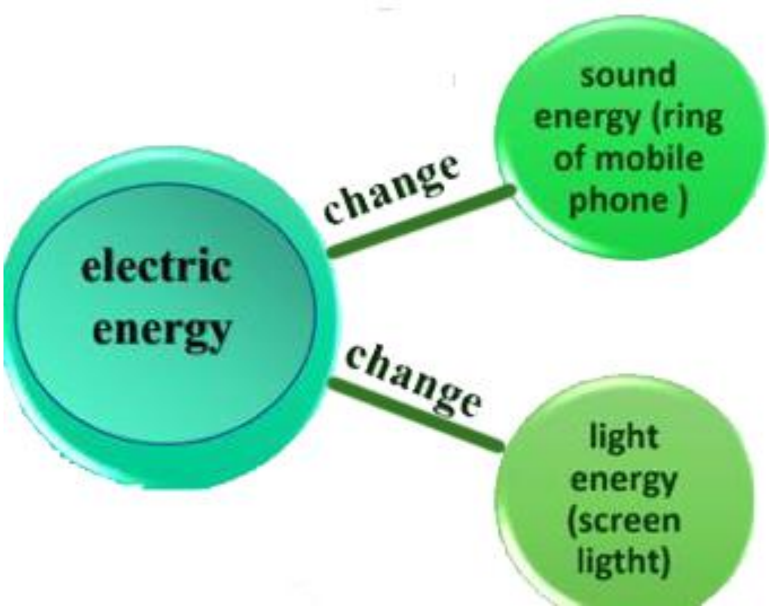




Technology help us to convert

Light energy comes from the

Ex:- solar energy → by solar cells → electric energy







Activity2 : The energy in car toys operating by remote control.

Some of toys which can be controlled by Remote Control as cars, trucks, plans and ships needs energy to Can be moved and do it functions as turning, move arms and using camera all of these instruments get its energy from electricity.



- **what happen if the charge of battery running out ?**
  - The remote control will be stopped.
  - we can recharge it by Connecting it with Power supply Or Replacing it with another battery.
- **What is the source of energy in batteries ?**

  The electric energy



- **what is the type of energy in batteries?**

  Chemical potential energy

- **What is the forms of energy inside the car** ?

  Chemical energy in battery change to Kinetic energy, light energy and Sound energy.

Mars exploration rover :

- **How the mars exploration get its energy ?**

- The distance between mars and earth Not less than 54 million km, it takes about 6 months to arrive To mars planet.
- Robots are send to mars to do specific functions as Curiosity Rover
- It need energy for long time Reaches to 6 months or more ... it is difficult to Change its battery or Charge it. due to the long distance

- **How Curiosity Rover can get its energy ?**

Uses solar panels and batteries (which are charged by solar energy) as a resource of energy where :

The vehicle change Solar energy into kinetic, heat, electric energies to operate its sensors to do its functions on mars surface.

Energy & the need of devices to it

Energy makes devices & toys move and do there functions, such as robots in angles, moving their arms or operating her cameras.

- The source of energy in devices and toys is the chemical energy stored as batteries.
- When batteries run out, devices stop.

To make a battery work again :

1- we charge it.

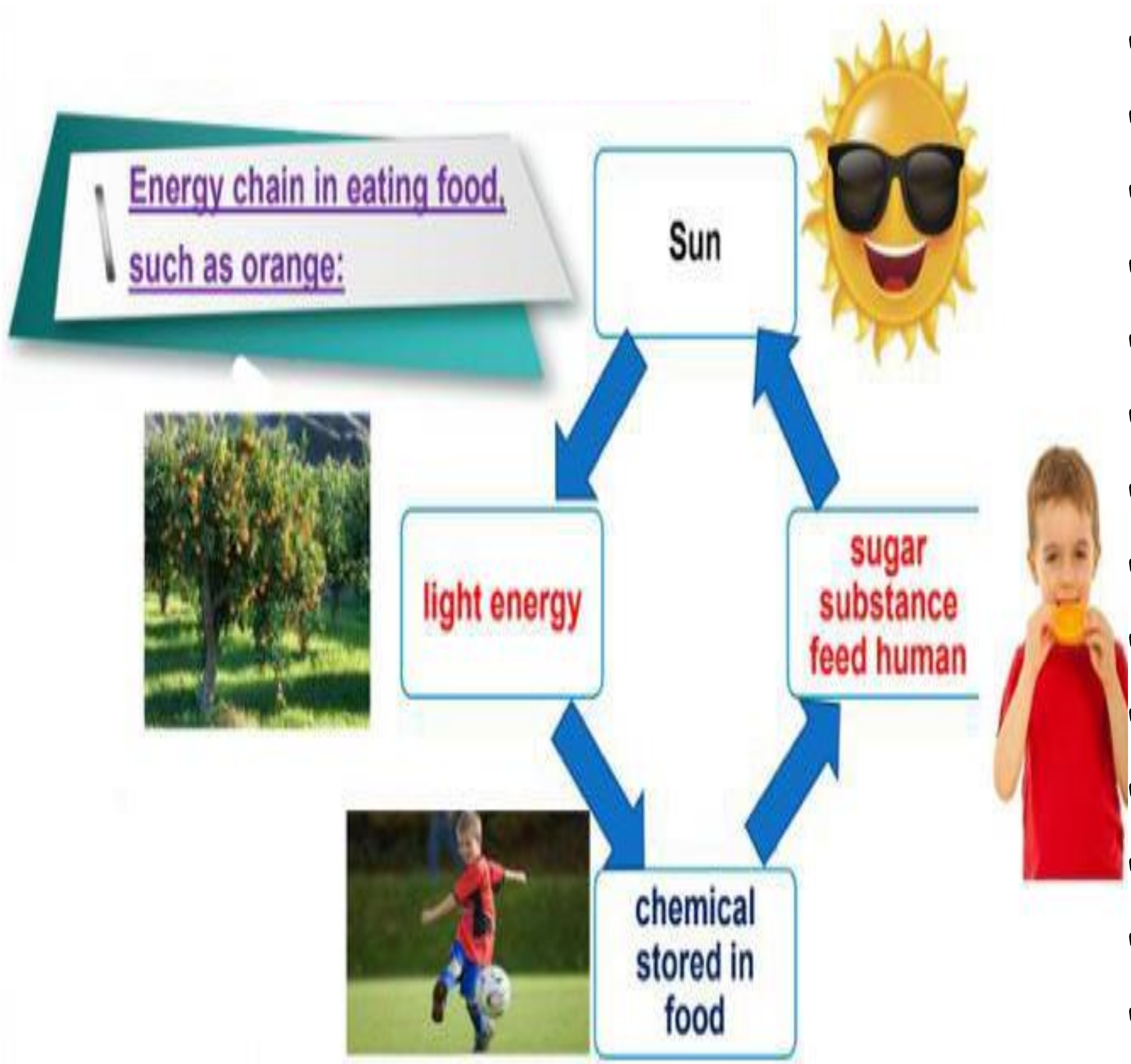
2- we exchange it by a new battery.

Energy Chains

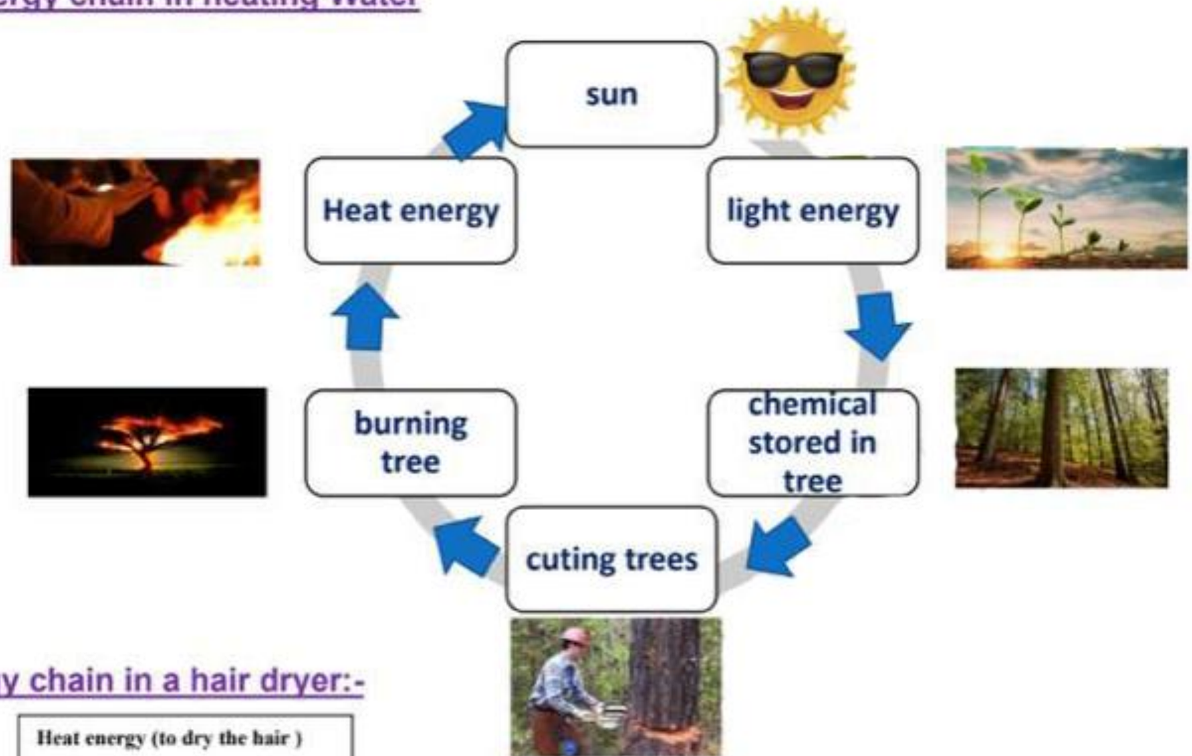
Energy Chains

- Where nuclear energy changes to light energy, which is absorbed by the plants to start the chain.
- The main source of energy is the Sun.

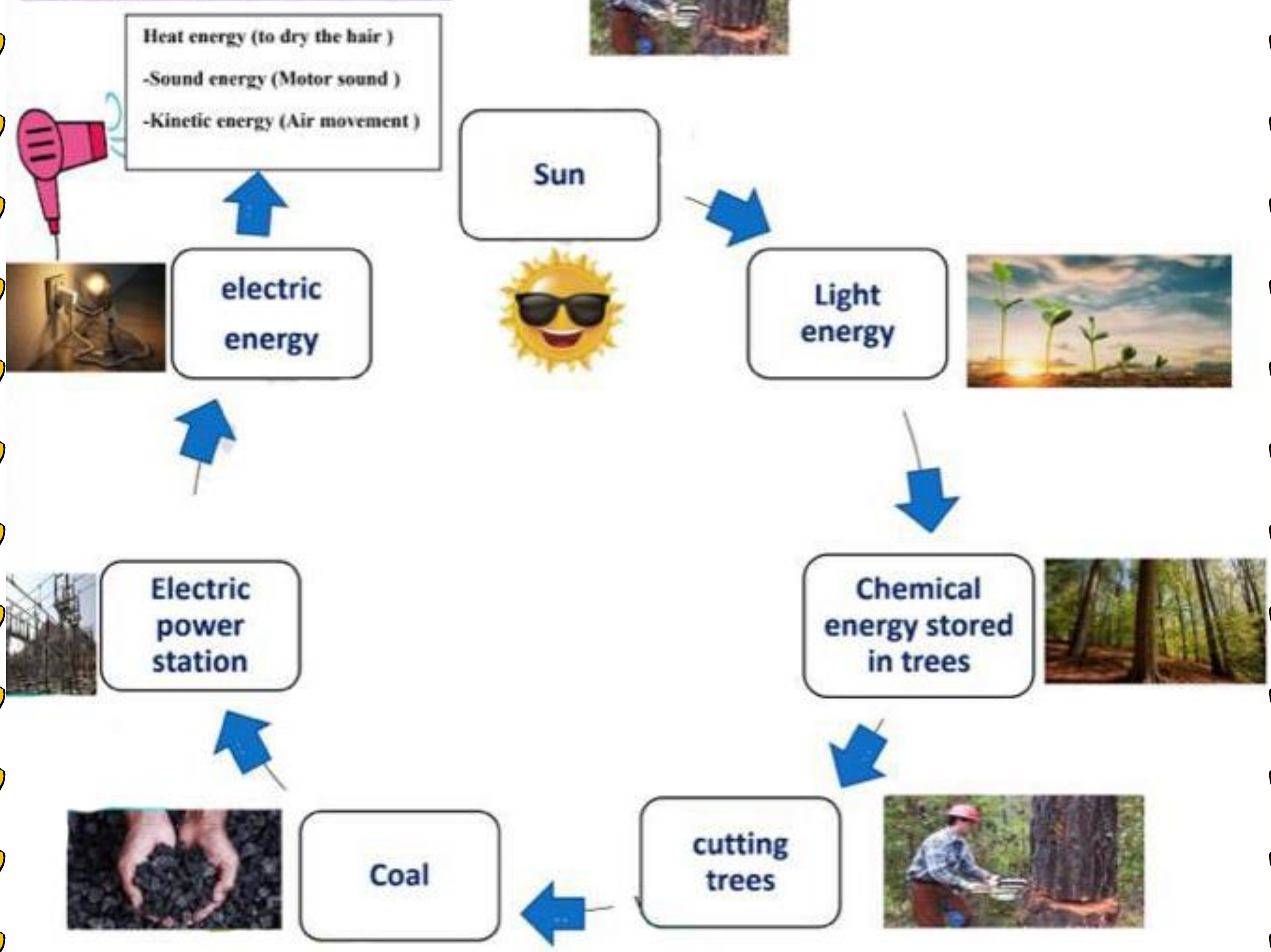
Examples of Energy Chains



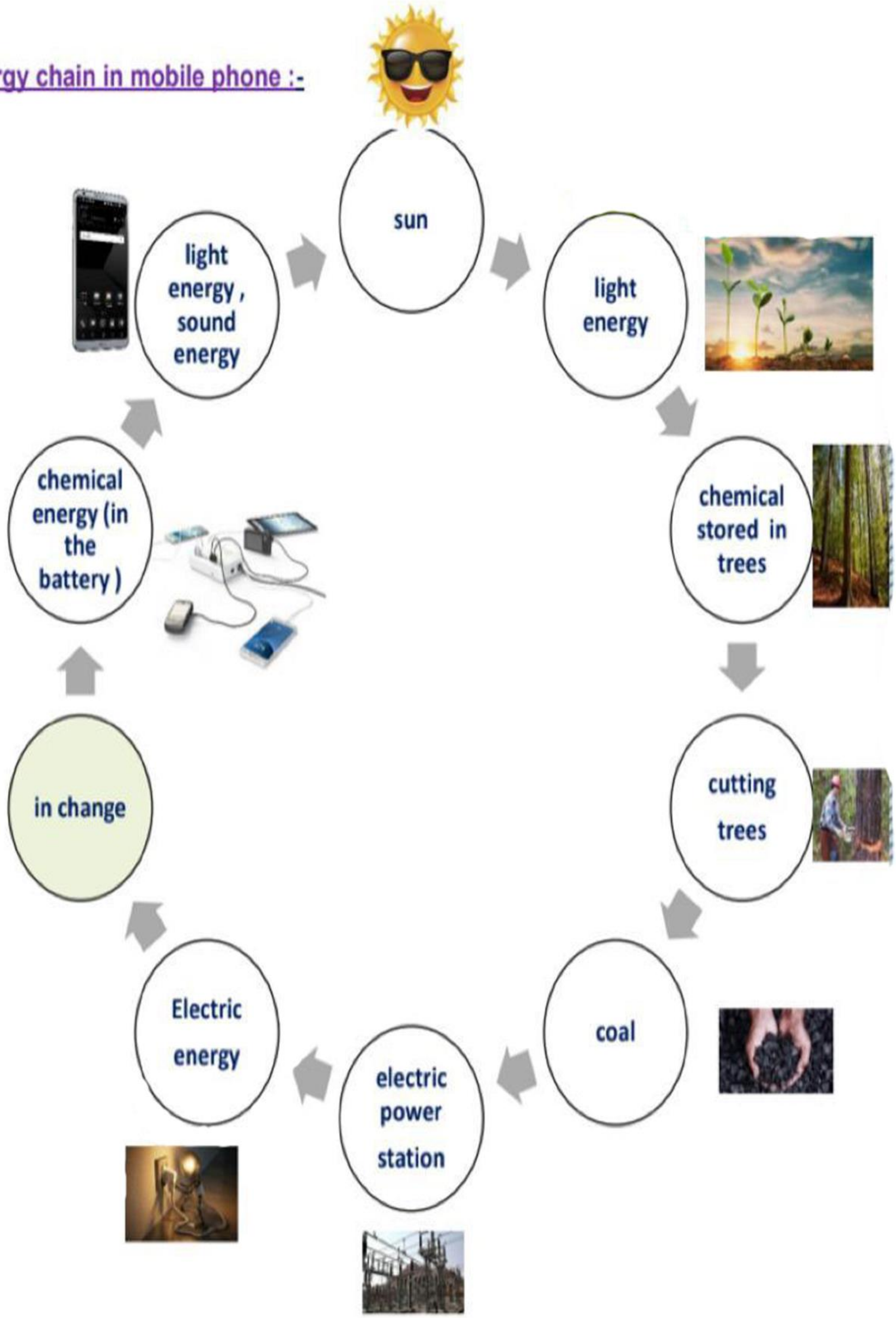
Energy chain in heating Water



Energy chain in a hair dryer:-

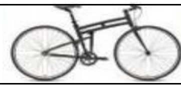


Energy chain in mobile phone :-



Energy transformations

Device		Function	Energy input (incoming, used, consumed energy)	Energy output (come out, produced energy)
Hair dryer		Drying hair	Electric	Sound kinetic Heat
Soap dispenser		Dispensing	Potential	Kinetic
Washing machine		Washing cloches	Electric	Kinetic
Electric bulb		Lighting houses	Electric	Light and heat
Motor engine		Moving things	Electric	Kinetic
Dynamo		Obtaining electricity	Kinetic	Electric

Mobile phone		Making calls	Chemical	Sound and light
Bike		transporting	Chemical	Kinetic
Electric iron		Ironing clothes	Electric	Thermal
TV		Transferring sound and image	Electric	Sound and light
Fan		Moving the air	Electric	Kinetic
Small watch		Knowing time	Chemical	Kinetic
Toy car		Toy car for kids	Electric potential	Kinetic
Hand bell		Getting attention	Kinetic	Sound
Electric heater		Warming	Electric	Thermal
Flashlight		Lighting up	Chemical	Light and thermal

From the previous examples, we can conclude that :

Energy can be changed from one form into another, where the new energy cannot be created from nothing, and the old energy does not disappear but it changes from one form of energy into another, this is called "the law of conservation of energy"

The law of conservation of energy :

Energy can neither be created nor destroyed, but only converted from one form of energy into another.

All devices have energy coming in and out of them, where:

- The energy that comes in a device is called "input energy'
- The energy that comes out a device is called "output energy".
- Some of the energy is lost in different forms, while traveling through the energy chain, where most of the lost energy leaks out in the form of heat.

Exercises1

(A) Put (√) or (×) :

1. The solar vehicle changes sound energy into kinetic energy. ( )

2. Mars rover curiosity can be operated from a distance.( )

3. The stored energy in batteries is the light energy. ( )

(B) Give a reason for the following :

Curiosity robot uses the sunlight and batteries for its operation.

....

....

(A) Write the scientific term of each of the following :

1. The main source of energy on the Earth. (.................)

2. The form of energy that is stored in battery of a remote controlling toy car. (.................)

3. The remote controlling vehicle that is used to explore the surface of Mars planet. (.................)

(B) Mention two devices can be operated from a distance by using a remote control.

....

....

Look at the opposite figure, then choose the correct answer:



1. This car needs .... to move.

a. water. b. wood

c. fuel. d. energy

2. To keep playing with the toy car when the battery runs out, we have to .... or recharge the battery.

a. heat. b. cool

c. replace. d. freeze

3. The type of energy that is used in operating this car is .... energy.

a. sound. b. light

c. thermal. d. electrical

Exercises 2

(A) Complete the following sentences:

1. When you rub your hands together, the consumed energy is .... energy, while the produced energy is ....energy.

2. The produced energy in a toy car is .... energies in a hair dryer are .... energy, while the produced energy and sound energy.

3. The produced energy from coal is .... energy, that is converted into .... energy used to operate the machines of electric power stations.

(B) Give a reason for the following :

The thermal energy produced from burning coal is used in some electric power stations.

....

....

(A) Put (√) or (×) :

1. Curiosity robot needs sound energy to be operated. (   )

2. The electric lamp is the primary source of most energies on the Earth. (   )

3. The electric iron converts electrical energy into thermal energy. (   )

(B) What happens if ... ?

You press on the spring of the soap dispenser.

(according to the change of energy).

....

....

Look at the opposite figure, then complete the following sentences:

1. This living organism can converts .... energy of the Sun into .... energy stored inside it.

2. If the wood of this organism is burned, ... energy is produced.

3. After death and burying of this organism over millions of years, it becomes coal that stores .... energy.

4. The formed coal can used in electric power stations to generate .... energy.



Exercises 3

(A) Choose the correct answer :

1. Mars rover curiosity uses .... to be operated.

a. solar energy and electrical energy

b. solar energy and thermal energy

c. electrical energy and thermal energy

d. electrical energy and sound energy

2. While playing a drum, ... energy changes into .... energy.

a. sound - kinetic

b. sound - light

c. kinetic - sound

d. kinetic - light

3. In the bicycle, the kinetic energy is converted into .... energy due to the friction of its tires with the road.

a. sound.   c. light

b. thermal.   d. chemical

(B) What happens if ... ?

You rub your hands together.

(according to the change of energy).

....

....

(A) Correct the underlined words :

1. Energy can neither be created nor destroyed, but only converted from one form to another, this is the law of <u>consuming</u> of energy. (   )

2. The consumed energy while burning some pieces of wood is the <u>thermal</u> energy. (   )

3. The lighted lamp produces <u>chemical</u> energy that makes you feel warmth when you put your hands near it. (   )

(B) Mention two devices that convert electrical energy into both kinetic and sound energy.

....

....

Look at the following figures, then complete the following sentences.


Device (1)


Device (2)


Device (3)


Device (4)

1. The electrical energy used to operate devices number ....,................ and ....

2. Kinetic energy is produced in devices ....and..............

Exercises 4

(A) Complete the following sentences:

1. The output energy of burning coal is .... energy, which is used to produce .... energy in electric power stations.

2. The output energy that helps the washing machine to do its main function is .... energy, and this energy is considered the .... energy of the hand bell.

3. The input energy of the toy car is .... energy that is stored in its battery and then converted into .... energy in its wires to operate its motor.

(B) Give a reason for the following :

Sound energy and thermal energy are considered as wasted energy in the washing machine.

....

....

(A) Write the scientific term of each of the following:

1. The input energy of a television. (..........)

2. The wasted energy of a computer. (..........)

3. The output energy of the washing machine which helps it to do its main function. (..........)

(B) Mention the input and output energies of the opposite device:



1. Input energy: ....

2. Output energy : ....

13 Look at these electric devices, then complete the following sentences :



Device (1)



Device (2)



Device (3)

1. Sound and light energies are produced in the device number .... and help it to do its function.

2. Kinetic energy is produced in devices number .... and ....

3. Noise from devices number .... and .... is wasted energy, because sound doesn't help the devices functions.

4. All of these devices are operated by .... energy that is transmitted from .... stations through wires.

Model Exam

(A) Choose the correct answer:

1. Mars rover curiosity is designed to explore ....

a. Earth planet. b. Mars planet.

c. the Sun. d. the moon.

2. Plants can convert the light energy from the Sun into .... energy which is stored inside the plant in the form of sugar.

a. sound. b. electrical

c. chemical. d. kinetic

3. When a piece of coal is burnt, ... energy is produced.

a. thermal. b. kinetic

c. sound. d. potential

4. Inside a light bulb, electrical energy changes into .... and .... energies

a. sound – light. b. sound - thermal

c. kinetic – light. d. light - thermal

(B) What happens if you put your hands near a lighted lamp ?

....

....

(A) Put (v) or (x) :

1. There is a stored chemical energy inside the food we eat. (   )

2. The input energy in a hair dryer is the chemical energy.(   )

3. As a result of friction between bike's tire and the road, kinetic energy changes into chemical energy. (   )

4. We can convert the solar energy into different forms of energy. (   )

(B) Look at the following figures, then complete the following energy chain



Figure (1)



Figure (2)



Figure (3)



Figure (4)



Figure (5)

Radiant energy → Converted into → Heat energy → Converted into → Kinetic energy → Converted into → Electrica lenergy

(A) Correct the underlined words :

1. <u>Light</u> energy is stored inside the battery of a mobile phone. (................)

2. Toy cars depend on fuel as a source of electrical energy. (................)

3. Light energy, thermal energy and chemical energy are produced when a mobile phone is used. (................)

4. The solar energy produced from the moon can be converted into different forms of energy. (................)

(B) Give a reason for the following :

When you press on the spring of soap dispenser, the soap moves upward .

(according to the change of energy)

....

....

(A) Write the scientific term of each of the following:

1. The energy that is used to operate a television. (...............)

2. Energy can neither be created nor destroyed, but only converted from one form to another. (...............)

3. A kind of energy that is produced from the electric heater and burning coal. (...............)

4. The energy produced from playing guitar. (...............)

(B) Choose from column (A) what suits it in both columns (B) and (C) :

(A) Energy used	(B) The device	(C) Energy Produced
1. Kinetic energy	a 	A. Thermal energy.
2. Electrical energy	b 	B. Chemical energy.
3. Solar energy	c 	C. Sound energy.

1. .... ⟶ 2. .... ⟶ 3. .... ⟶

Unit 3 concept 2

Lesson1

Activity 1 Can You Explain?



Natural gas



Gasoline (oil)



Coal

• Fuel is one of the most important resources of energy that humans depend on to get energy, so where does the fuel we use every day come from?

Fuel :

It is any substance that produces thermal energy when it is burned.

- **The main source of thermal energy that is produced by fuel, is the Sun.**

• The pictures above show several forms of fuels that we use in our daily lives, where : Oil, coal and natural gas are considered from forms of fuels that are extracted from the underground and they are the most commonly used fuels in our lives as they are used in warming, running transportation and generating electricity.

Activity 2 Fuels and Road Trips

Yes (   ) No(   )

- 1. Can cars move on roads when they run out of fuel ?



Yes (   ) No(   )

- 2. Do cars need fuel to get energy to move ?

- There must be fuel in the car to move again after it stops, where the fuel burns inside the car engine producing thermal energy that is converted into kinetic energy which causes the car to move

Activity 3 What Do You Already know About Fuels?

► From the previous activities you have learnt that fuel is any substance produces thermal energy when it is burned. Among the several forms of fuel are :

produces thermal energy when it is burned. Among the several



Gasoline (oil)



Natural Gas



Woo



Coal

• Now, we will learn more about different forms of fuel and their uses.

➢ Uses of some different forms of fuel Fuel is used for several purposes, such as :

✓ Cooking food, where coal, natural gas or wood may be used.



✓ Generating electricity, where oil, natural gas or coal may be used.



✓ Warming, where coal or wood may be used in warming



✓ Operating all means of transportation, where gasoline (oil) or natural gas may be used.



The thermal energy produced from the same form of fuel can be used for different purposes, as shown in the following two energy chains :

The use of coal in cooking :	The use of coal in generating electricity :
Light energy (from the Sun) 	Light energy (from the Sun) 
Chemical energy (stored inside coal) 	Chemical energy (stored inside coal) 
Thermal energy (when burning the coal) 	Thermal and kinetic energies in electric power stations)
	Electrical energy (is transferred through electric wires)

Note : **Gasoline is a fuel that is made from petrol oil.**

Lesson 2

Activity 4 Types of Fuel

The following pictures show several forms of fuel. Complete the following sentences using the words below pictures (you may use one word more than one time).



Gasoline (oil)



Wood



Coal



Natural gas

1. **From forms of fuel that are used in cooking food are……,………..or………**
2. **From forms of fuel that are used in generating electricity are……or…….**
3. **From forms of fuel that are used in operating all means of transportation are………**

► **In the previous lesson, you have learnt that fuel is one of the most important resources of energy and these resources are divided into:**

1- Renewable energy resources	**2-Non-renewable energy resources**
They are natural resources that can be replaced after a short period of time of usesuch as: water , solar energy and wind energy	**they are natural resources that are used ata rate faster than they can be replaced, such as: coal , natural gas and oil.**
Renewable energy resources: Are those that continually renew or replacethe part that has been consumed (used), so they will not run out	**Non-renewable energy resources Are those that run out when consumed (used), and cannot be renewed in a shortperiod of time**

➢ Types of fuel can be classified into:

1-Biofuel

- It is a fuel that is produced from living organisms that can be planted (i.e., plants).
- Biofuel is a renewable energy resource that is continually renewed as plants grow, so it is known as "renewable fuel".
- Its primary source: The Sun Examples:

1. Wood is the oldest fuel that is still used all around the world in warming and cooking food.



is made from wood and itis one of the most important forms of fuel.



3. Some types of plants such as grass, corn and wood chips can be used to makea liquid fuel.



Conservation of biofuel :

Although biofuel is a renewable energy resource, it should be conserved "rationalized , where :

Using wood as a source of energy requires cutting down trees

Rapid cutting trees (knowing as (deforestataion) causes negative effects on the environment

Therefore ,the wood we use should be continuously rationalized sohtat itwill not run out .

Note

Many trees grow a few centimeters each year, while some trees reach their full height in a period nearly equals the human's lifetime. This means that the growth of these trees takes more than one human's lifetime to complete their growth.

2- Fossil fuel

- It is a fuel that is produced from old living organisms (plants or animals) that were buried and decomposed over a long period of time.

- Is a non-renewable energy resource, because once it is consumed, it runs out faster than it can be renewed.
- Its primary source : The Sun Examples:





1. Oil and natural gas are formed when the remains of marine organisms (sea animals) were decomposed.

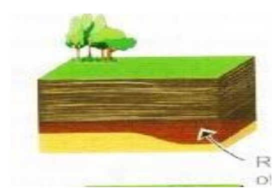
2. Coal is formed when the remains of plants were decomposed.

Formation of coal :

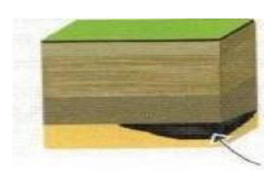
300 million years ago, large areas of the Earth were covered with swamps, with a lot of plants growing nearby.



When those plants died, their remains were decomposed and covered by hundreds of meters of mud and rocks.



Due to the effect of extreme heat and pressure, those remains were turned into coal.



Conservation of fossil fuel :

-Non-renewable fossil fuels should be conserved and alternative resources should be found as :

• Fossil fuels (coal, oil and natural gas) take millions of years to be formed, as they are consumed faster than they are formed. Once they are used, they start to run out **because they can't be easily renewed**.

- Oil and water are considered from resources that are used by humans to generate energy.
- Oil has a structure differs from that of water.
- Oil is a non-renewable energy resource, while water is a renewable energy resource. Formation of oil :
- Oil is extracted from the underground as a result of decomposition of marine organisms, where :

When those marine organisms died, their remains settle on the ocean floor.

Over millions of years, layers of sediments and rocks cover the remains of those marine organisms, this results in extreme heat and pressure.

Over time, as a result of extreme heat and pressure, those remains converted into oil

Conservation of oil :

- Oil is consumed at a rate greater and faster than the production of new oil, so it should be rationalized in order to avoid running out through many ways such as:

1- Reducing the use of private vehicles.

2- Using of public means of transportation.



Conservation of water :

- People should use water carefully and rationalize its using through many ways such as:

1- Avoid wasting or polluting water, because we may not be able to replace it as quickly as we need.

2- Growing plants that do not need large amounts of water for irrigation.

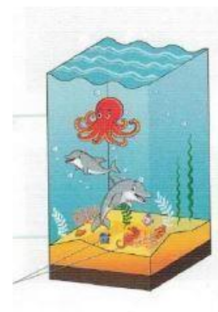


Lesson 3

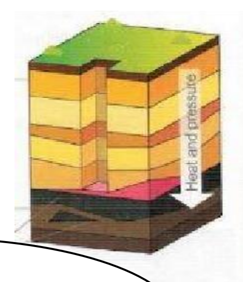
Activity 7 Fossil Fuel Formation

➢ **Arrange the following steps to know how the fossil fuel is formed :**

The remains of marine living organisms were buried and decomposed under sediments and rocks.

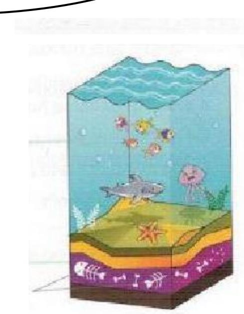


Due to the effect of extreme heat and pressure, the remains of marine living organisms were turned into oil or natural gas.



Oil or natural gas

The death of marine living organisms that have lived since ancient times.



Activity 8 Living Without Electricity

- - fossil fuels are non-renewable energy resources which are used to generate electrical energy, where, natural gas and oil are used to generate electricity in many regions, so they should be conserved.
- -Renewable energy resources such as hydroelectric energy (from waterfalls and dams) and wind energy are also used to generate electricity.
- Whatever the resource of energy is renewable or non-renewable, we should conserve the energy through many ways such as:

1- Turning off lights when they are not needed.



2)Unplugging electrical appliances when not in use.



- **Imagine the electric current being cut off while you were studying, you can use simple ways to keep studying, like :**

  1- Using candles instead of the electric lamps.

  2- Writing with a pen and paper instead of using a computer.

- **From the above example, we conclude that electrical energy is very important in our lives and should be conserved.**

Activity 9 Using Fossil Fuels to Generate Electricity

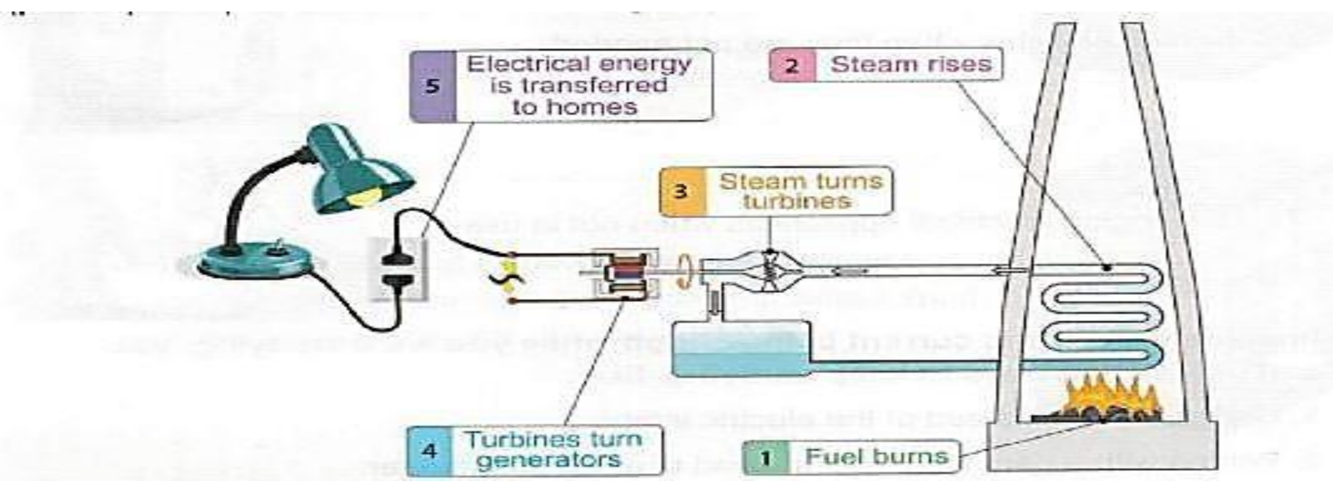
➢ **As you knew from the previous lessons that fossil fuels have many uses including:**

1. The use of gasoline and natural gas to operate cars.

2. The use of oil, coal and natural gas to generate electricity.

- **Now, we will study how fossil fuel can be used to generate electricity, which is used to light homes.**

How fossil fuel is used to produce electricity



1- **Fuel burns**

When fuel burns, it produces thermal energy.

2- **Steam rises**

This thermal energy is used to heat water producing steam.

3- **Steam turns turbines**

The steam goes inside tubes to be used to operate devices called turbines.

4- **Turbines turn generators**

The movement of turbines produces kinetic energy, which is used to operate the generator.

When the generator is turned on, it converts the kinetic energy into electrical energy.

5- **Electrical energy is transferred to homes**

Finally, the electrical energy is transferred through cables (wires) to homes to operate different devices.

Lesson 4

Activity 10 : Big City Environmental Concerns

➢ **Put (√) in front of the picture that shows environmental pollution .**


( )

( )

( )

- From the previous lessons, you have learnt that fossil fuels have negative effects on the environment.

• In this lesson, we will study that fossil fuels have many bad effects in big cities, where the increase of people's needs and their industrial and agricultural activities cause pollution problems around the world.

Some sources of pollution in big cities

1- Burning fuel produces smog, which pollutes the air.



2- Pesticides used on farms are mixed with water in canals and rivers when rain falls, this lead to pollution of soil and water.



3- Using chemicals in factories pollute the air and also the nearby water sources and soil.



Some effects (impacts) of air pollution on human's health



1. Smog from cars cause irritation of human's eyes and lungs.
2. Scientists have found that smog contains tiny particles that the human breathes in, these particles irritate the lungs, causing the damage of tissues of the respiratory system.

Activity 11 Burning Fossil Fuels and Pollution

• In the previous lessons, you have learnt that extracting fossil fuel from the underground harms the environment and when burning this fuel to generate electrical energy, this pollutes the environment.

People need energy to operate trains, cars and ships, and even more energy is needed to supply houses, schools and factories with electricity.

• To get this energy, the solution was to extract and use fossil fuels to generate electrical energy, where :



Coal, oil or natural gas is burned at electric power stations and the energy produced from burning fuel is used to generate electricity.

- **Then, the generated electricity is transferred to different places through electric wires.**

Harms of burning of fossil fuels on the environment

-Burning fuel not only produces electricity but also pollutes the environment, where burning of coal and oil produces carbon dioxide gas which causes :

1- Acid rains	2-Global warming
Carbon dioxide gas combines with water in the air to from carbon acid ,resulting in acid rains that cause: 1- The death of trees. 2- Decomposition and dissolving of some global warming. rocks includingbricks of buildings. 3- Chemical changes in the structureof lakes causing the death of fish. 4- Chemical changes in the structureof soil	Increasing the amount of carbon dioxide in the air to form carbonic acid, resulting gas in the air forms a layer in the in acid rains that cause : 1-atmosphere that traps heat above the Earth's surface causing a slow rise in the Earth's temperature, which is known as global warming .

How to reduce acid rains and global warming

- The best solution to reduce acid rains and global warming is to rationalize (decrease) the use of energy, where:
  - As we reduce our consumption of energy, the amount of burning of fossil fuel to generate energy decreases.
  - As the amount of burning of fossil fuel decreases, the amount of carbon dioxide and other pollutants in the air which we breathe in will decrease. Note Decreasing the use of energy not only reduces pollution but it also conserves non-renewable fossil fuels and keeps the Earth planet clean.

Lesson 5

Activity 12 Conserving Fossil Fuels

➢ **Look at these pictures, then answer:**



Is fossil fuel used to cook food?

(yes) (No)



Is fossil fuel used to generate electricity to light homes ?

(yes) (No)

From the previous lessons, you have learnt that how fossil fuels burn to generate electricity that lights our homes, so we should conserve this type of fuel, where:

- There is a limited amount of fossil fuels available on the Earth.
- Fossil fuels are formed over millions of years, this means what we use cannot be replaced as quickly as it is consumed.
- Fossil fuels are considered non-renewable natural resources of energy that will run out from the Earth if consumption is not rationalized.

Some methods of conserving fossil fuels

1- Walking or using bicycles instead of driving a car.



2- Turning off the lights when you are not in the room.



3- Replacing fossil fuels with renewable energy resources such as : solar energy, hydroelectric energy and wind energy.



Disadvantages of using fossil fuels in energy production

- The amount of fossil fuels is limited and could run out.

• When fossil fuels burn, they emit gases that cause :

- Air pollution.
- Trap heat in the atmosphere, which raises the temperature of Earth planet and changes its climate. This phenomenon is known as "global warming."

Note :

The use of renewable energy resources instead of fossil fuels means that renewable energy resources will not run out and so this will not cause an increase in Earth's temperature but production of energy by using renewable energy resources is more expensive than using fossil fuels.

Exercises1

(A) Choose the correct answer:

1. To move a car, the fuel must be .... at first.

a. freezed.

b. cooled

c. burned inside the car engine

d. removed from the fuel tank

2. During driving a car for a long distance, which of the following sentences describes the most important thing for the driver?

a. The presence of a speedometer.

b. The presence of a radio.

c. The fuel tank contains enough amount of gasoline.

d. The fuel tank contains a little amount of gasoline.

3. On burning fuel we obtain

a. sound energy.

c. electrical energy.

b. potential energy.

d. thermal energy.

(B) Give a reason for the following :

The importance of wood and coal in our houses.

....

....

(A) Put (√) or (×) :

1. Energy that is produced from burning gasoline, cannot be used to move a car. (   )

2. Burning of all forms of fuel produces thermal energy. (   )

3. If the fuel decreases in a car during driving, the driver must stop at the nearest fuel station to supply the car with gasoline. (   )

(B) Mention three different forms of fuel.

....

....

Put each of the following words in front of the suitable sentence:

[The Sun - Wood - Gasoline - Thermal energy]

1. It is a form of fuel that is used in different means of transportation. (..................)

2. It is a form of fuel that is used in warming houses. (..................)

3. It is a form of energy which is produced from burning fuel. (..................)

4. The main source of most energies on the Earth's surface. (..................)

Exercises 2

(A) Choose the correct answer:

1. Car engines can be operated by ....

a. coal only.

b. coal and wood.

c. gasoline only.

d. gasoline and natural gas.

2. The fossil fuel are formed under the Earth's surface from dead plants or animals, after a .... period of time.

a. very short

b. short

c. very long

d. long

3. The two main types of fuel are ....

a. wood and coal.

c. the Sun and the moon.

b. water and wind.

d. fossil fuel and biofuel.

(B) Give a reason for the following :

Biofuel is considered as a renewable fuel.

....

....

(A) Put (√) or (×) :

1. Coal can be used to produce electrical energy. (   )

2. Coal, gasoline and wood are considered as renewable resources of energy. (   )

3. The non-renewable resources of energy include coal, gasoline and water. (   )

(B) What happens if ... ?

Marine organisms were buried under the Earth's surface over millions of years.

....

....

Choose from column (B) what suits it in column (A) :

(A) Form of fuel	(B) We can get it from
1. Wood	a. wood chips and grass.
2. Gasoline and natural gas	b. cutting of trees.
3. Coal	c. decomposition of marine animals.
4. Liquid biofuel	d. decomposition of plant remains.
	e. boiling water.

1. .... 2. .... 3. .... 4. ....

Exercises 3

(A) Choose the correct answer:

1. To produce steam inside the electric power station, we have to ....

a. cool the water.

b. freeze the water.

c. heat the water.

d. cool the fuel.

2. The devices in the electric power station which operated by steam are ....

a. the generators.

b. the turbines.

c. the tubes.

d. the cables.

3. The generator inside the electric power station, turns ....

a. water into steam.

b. steam into water.

c. electrical energy into kinetic energy.

d. kinetic energy into electrical energy.

(B) What happens if ..... ?

An electric generator in a power station is damaged.

....

....

(A) Put (√) or (×) :

1. The function of turbines in electric power station is similar to that of generators. (   )

2. Turbines convert kinetic energy into electrical energy.(   )

3. The electrical energy that is produced from electric power station, can be used in houses, streets and factories.(   )

(B) Complete the following sentences by choosing the correct answer from those between brackets :

1. Fossil fuel are [non-renewable - renewable] resources of energy which are used to generate electrical energy.
2. Turbines in electric power stations are operated by the effect of [steam - sand].
3. Electrical energy travels from electric power stations to houses through [cars - cables].

B From your understanding of how electricity is generated in electric power stations. Put each of the following words in front of its suitable sentence:

[Coal - Steam - Turbine - Generator}

1. Its movement produces kinetic energy. (.............)
2. It changes kinetic energy into electrical energy. (.............)
3. It is a type of non-renewable resources of energy. (.............)
4. It is resulted from heating the water and it turns turbines. (.............)

Exercises 4

(A) Choose the correct answer:

1. When carbon dioxide gas increases, the Earth's temperature ....

a. decreases slowly.

b. increases slowly.

c. decreases fastly.

d. doesn't change.

2. All forms of fossil fuel are formed ....

a. above the Earth's surface.

b. under the Earth's surface.

c. above the water surface.

d. in the air around us.

3. We have to protect stones of buildings from ....

a. global warming.

b. oxygen gas.

c. acid rain.

d. carbon dioxide gas.

(B) Give a reason for the following :

Burning of coal and oil causes the increase of the Earth's temperature.

....

....

(A) Put (√) or (×) :

1. Acid rain causes global warming. ( )
2. Mixing of water with oxygen gas produces carbonic acid. ( )
3. Acid rains have negative effects on both soil and water of canals. ( )

(B) What happens if ..... ?

Some people live in a city that has too much cars smog.

(according to the human health).

....

....

Scientists do some experiments to know the bad effects of some different sources of pollutions on different living organisms.

Match each experiment with its correct observation :

The experiment	The observation
1. Exposing a dog to cars smog for a few minutes 2. Placing a building stone in a cup contains a sample of acid rain for a long period of time 3. Watering a small plant with acid rain for a week	a. its leaves turn brown and it will die. b. irritation of its eyes and lungs. c. it -will decompose into small rocky particles.

1. ....2. .... .3.......................

Exercises 5

(A) Choose the correct answer:

1. The energy that originally causes the formation of the non-renewable fuels is ....

a. wind energy.
b. water energy.
c. solar energy.
d. electrical energy.

2. As the time passes, the amount of coal will ....

a. increase.
b. decrease.
c. remain constant.
d. increase then decrease.

3. Burning of fossil fuel produce....................

a. only gases that pollute the air.

b. only thermal energy.

c. gases that pollute the air and solar energy.

d. thermal energy and gases that pollute the air.

(B) Give a reason for the following :

Burning fossil fuel causes global warming phenomenon.

....

....

(A) Put (√) or (×) :

1. Renewable forms of fuel can be replaced faster than non-renewable forms of fuel. ( )
2. Burning fossil fuel produces gases that don't cause global warming. ( )
3. Burning coal emits gases which cause air pollution. ( )

(B) What happens if ...?

The amount of gases produced from burning of fossil fuel increases to very high limit.

(according to Earth's temperature)

....

....

Complete the following paragraph by using the following words:

[global warming - heat - raises - gases]

From disadvantages of using fossil fuel is that when it is burned, it emits .... that cause air pollution and .... trapping in the atmosphere, which .... the temperature on the Earth, that causes .... phenomenon.

Model Exam

(A) Complete the following sentences:

1. Some forms of fuel can be used in cooking such as ....,............. and ....

2. The electric generator changes .... energy into .... energy.

3. Using the .... resources of energy is more expensive than using fossil fuel.

4. Different forms of fuel can be classified into two main types which are .... and ....

(B) Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Water 2. Wind energy 3. Coal	a. it needs extreme heat and pressure to be form from remains of dead plants. b. it is the main resource of energy on the Eart surface. c. it is a gaseous renewable resource of energy. d. it is a liquid renewable resource of energy.

1. .... 2. .... 3. ....

(A) Correct the underlined words :

1. Fuel is the matter that produces <u>electrical energy</u> on burning. (.....................)

2. Wood is a form of <u>fossil fuel</u>, that can be used in houses. (.....................)

3. Hydroelectrical energy, is used to produce <u>water</u> from waterfalls and dams. (.....................)

4. Gases emitted from burning fossil fuel always <u>clear</u> the air. (.....................)

(B) What happens if ....?

We use renewable resources of energy instead of fossil fuel

(according to Earth's temperature)

....

....

(A) Put (√) or (×) :

1. Wind energy will run out faster than natural gas. ( )

2. Turning off lights that we do not need, is a way to conserve electricity. ( )

3. We can make liquid biofuel from wood chips and grass.(   )

4. As the speed of the car increases, the amount of used fuel decreases. (   )

(B) Arrange the following steps to show how electricity is generated in electric power station and sending it to houses and factories:

(.......) Steam turns turbines that produce kinetic energy.

(.......) Fuel burns and produces thermal energy.

(.......) Electrical energy sent to houses and factories.

(.......) Water becomes hot and produces steam.

(.......) Turbines turn generator that produces electrical energy.

(A) Choose the correct answer :

1. Coal is formed under the Earth's surface from the remains of.................

a. dead animals. b. dead plants.

c. dead humans. d. dead insects.

2. Among the following resources, we must conserve ....

a. solar energy and coal.

b. solar energy and wind energy.

c. wind energy and oil.

d. oil and coal.

3. All the following are found deeply under the Earth's surface, except ....

a. natural gas. b. coal.

C. green plants. d. oil.

4. All the following are used to generate electrical energy, except ....

a. oil. b. natural gas.

c. waterfalls. d. rain water.

Give a reason for the following :

Cutting trees to obtain wood has negative effects on the environment.

....

....

Unit 3 concept 3

Lesson1

Activity 1 Can You Explain?

Solar panels



Wind mill



Water mill



What are the various methods for generating electricity from renewable energy resources?

1- **From the previous pictures, we notice that the examples of renewable energy resources include:**

-Solar energy (sunlight),

-wind energy.

-watermill energy

- Electricity can be generated using the previous renewable energy resources in different ways, where :

- Solar panels use solar energy to generate electricity which is used to light streets.

- Windmill turbines generate electricity by using the kinetic energy of wind.

- Watermill turbines generate electricity by using the kinetic energy of water.

► **In this concept, we will study:**

- **Windmills and watermills.**
- **Renewable energy resources.**
- **The Sun and the use of solar energy.**
- **Ways to generate useful energy using the wind movement.**
- **Ways to generate electricity using the kinetic energy of water. Notes for parents.**



Activity 2 Windmills and Watermills





Put (√) in front of the device that is operated with electricity :

- **Manual mixer ( )**
- **Electric mixer. ( )**

- You know that most of the devices around us need electricity to be operated, but how didhumans use devices hundreds of years ago before electricity?

Windmills and watermills

- Hundreds of years ago, people needed machines to make their lives easier, for example, they used windmills and watermills which helped them to grind grain to make flour.

- The following table shows the energy used in windmills and watermills as well as the advantages and disadvantages of each :

Points of comparison	**Windmills**	**Watermills**
Energy used:	The wind movement generates kinetic energy which moves the mill's blades, then kinetic energy goes to other parts of the mill to grind the grain.	The water movement generates kinetic energy which moves the mill's blades, then kinetic energy goes to other parts of the mill to grind the grain.
Advantages :	• Low cost. • Renewable energy resourc	• Low cost. • Renewable energy resource.
Disadvantages:	Sometimes the wind does not blow and the windmills do not move, so they are unable to do their job.	The water supply may dry up and the watermills do not move, so they are unable to do their job.

Note:

Modern wind turbines and old windmills vary in shape and number of blades, but both are used to generate electricity.


Modern wind turbines


Old windmills

Activity 3 What Do You Already Know About Renewable Energy Resources?

- - You have known that any device we use needs energy to be operated.

- - The following table shows examples of renewable and non-renewable energy resources :

Energy resource	Renewable or Non-renewable	Example
Battery	**Non-renewable**	**Flashlight** 
Gasoline	**Non-renewable**	**Car engine** 
Solar panels (sunlight)	**Renewable**	**Lighting lamps**
Coal used in electricpower Station	**Non-renewable**	**Fan** 
Natural gas	**Non-renewable**	**Stove** 

Lesson 2

Activity 4 The Sun

-Look at the following pictures, then put (√) or (×):

(In a lighted room)



(In a dark room)

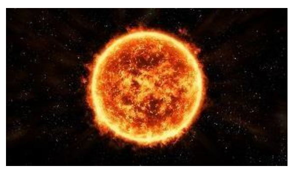


2. Plant (1) requires sunlight in order to grow.

3. Green leaves of plant (2) will turn yellow.

1. Plants require water only to grow.

- the Sun is important to keep life on Earth.
- The Sun provides us with light and heat.
- Plants need sunlight to grow and without the Sun, plants would not be able to
- survive, so they will die and the animals that eat them will die, too, so life on Earth will disappear.



Sun

1- Sun is the star made up of gases hydrogen and

2- Sun doesn't have a hard surface like the moon , but it has surface known as photosphere

3- The photosphere is a gas layer at sun surface where the light we see emitted.

How does the Sun produce light and heat ?

- The energy of the Sun comes when hydrogen and helium gases in the Sun react at very high temperatures, producing huge amounts of light and heat.
- Light and heat travel through space in the form of waves, some of these waves reach the Earth.

Note:

Do not look directly at the Sun as its rays are too strong and can harm your eyes.



Activity 5 Using Energy From the Sun

- In the previous activity, you have learnt how the Sun is important to living organisms, as most plants and animals need the Sun to survive.
- Now, let's know how the energy of the Sun reaches us on Earth and how we use it in our daily life.
- At night when the Sun is not visible in the sky, you can feel warm because :

1- The atmosphere absorbs the energy of the Sun.

2- Land and water on Earth's surface absorb the energy of the Sun, which causes a rise in the Earth's temperature.

➢ Solar energy

- The energy comes from the Sun is called "solar energy", which is radiant light and heat from the Sun.
- The solar energy that is produced by the Sun contains a type of energy called "radiant energy" (radiation) which is found in the Sun rays.

Uses of solar energy

Direct source of thermal energy

Solar energy can be used directly as a source of thermal energy when exposing yourself to the Sun to feelwarm



In greenhouses

Where, greenhouses allow the entry of solar energy (especially radiant energy) that comes from the Sun, then this radiant energy is converted into thermal energy that warms the inside of the greenhouses, which helps farmers to plant the crops that only grow in warm climates



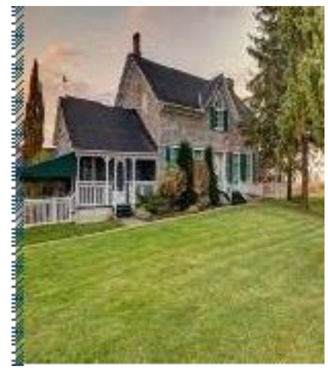
In heating water

Where, panels made of black pipes can be placed on the roof of houses to heat the water when it passes through these pipes, then the heated water is stored in a water tank to be used later.



In warming houses

Where, houses can be built in a way that enables the energy of the Sun to warm them by placing large windows on the walls that face the Sun for most of the day.



In cooking food

Where, curved mirrors are used to collect and focus Sun rays to heat metal pots and cook the food inside.



Activity 6 Solar Energy

➢ **how solar panels convert solar energy coming from the Sun.**

Solar panels

- Solar panels can be very small that they can supply only one light bulb with energy, or very large that they can supply buildings or cities with energy.



Solar panels

-How do solar panels work?

- Solar panels are composed of many small solar cells.
- These cells capture solar energy (especially radiant energy) coming from the Sun and convert it directly into electrical energy or thermal energy.

- Most solar panels are used to generate electricity.

➢ Uses of electricity generated by solar panels

- This electricity can be used directly to light the streets.
- This electricity is used to recharge some types
- of batteries, like some calculators with small solar cells.
- This electricity is used in houses to operate various electric devices.



Lesson 3

Activity 7 Harness the Wind

➢ -Put (√) next to the renewable energies :


( )
Coal


( )
Water


( )
Wind


( )
The sun

Note:

let's know how wind turbines convert kinetic energy of the wind into electricity,

➢ -Using energy of the wind

Different amounts of solar energy (especially radiant energy) reach different regions of the world.

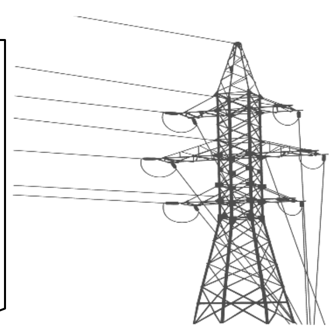
Radiant energy causes the air around the globe to heat up to different degrees, where the difference in temperature between cold and hot air causes air to move and wind to blow.



Kinetic energy of the wind movement is used to rotate the blades of windmills.



When the windmill blades rotate, this causes wind turbines inside the windmill to rotate, generating electrical energy that is transmitted through huge wires in power lines to different places such as houses and factories.



➢ The following diagram shows the energy chain of the wind turbines :

Radiant energy (From the Sun) → Converted into → Heat energy (When temperatures vary between hot air and cold air) → Converted into → Kinetic energy (In wind turbines) → Converted into → Electrica lenergy (In power lines)

Note:

•In water turbines :

-When the number of blades decreases, they rotate faster, so the efficiency of wind turbine increases.

-When the kinetic energy of wind increases, the blades rotate faster, so the efficiency of wind turbine increases.

-When the wind blows from the side of wind turbine, the blades rotate faster, so the efficiency of wind turbine increases.

When the wind blows from the front of wind turbine, the blades rotate slower, so the efficiency of wind turbine decreases

Lesson 4

Activity 9 Falling Water





➢ **Look at the following pictures, then put (√) or (×):**

Turbine (1) Turbine (2)

- Turbines (1) and (2) are used to generate electricity. ( )
- Turbine (2) uses the kinetic energy of water to generate electricity. ( )
- Turbine (1) is used in places, where there are strong winds to generate electricity. ( )

- **You have known that wind can be used to generate Electricity.**

- Now, we will study how water can be used to generate electricity.
- Rivers flow downhill and during this process the gravitational potential energy of water is converted into kinetic energy that helps rotate water turbines to generate electricity.
- Dams are built on rivers to control the water flow and increase the potential energy of water to generate electricity.

Falling water

How can electricity be generated from dams using water turbines ?

The flow of water can be controlled to generate electricity, as the dam prevents the flow of water, so the potential energy of water increases.

When water is released, it flows through water turbines in dams.

The flow of falling water helps water turbines rotate and generate electricity.

This electricity is sent through long electric wires to the places where it is needed, and this type of electricity is called "hydroelectric energy" or "hydroelectricity".



➢ Hydroelectric energy (hydroelectricity):

It is a type of electrical energy generated by water turbines in dams.

-The following table shows the similarities and differences between the use of water and the use of wind to generate electricity :

The use of water to generate electricity		The use of wind to generate electricity
Water is used in places wheredams are built on rivers.	- Differences	Wind is used in places with strong winds.
- Both are renewable energy resources. - Both of them operate turbines.	Similarities	- Both of them use kinetic energy. - Both of them generate electricity.

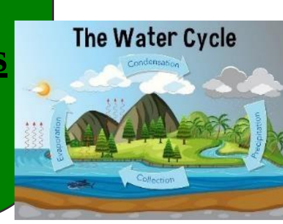
Lesson 4

Activity 10 Modeling a Turbine Generator

- The blades rotate when water is poured over them and stop when the water inside the jug is completely run out.
- When the water in the jug runs out, refill it with water from the bowl and pour water over the blades again.
- Water is a renewable energy resource.
- The kinetic energy of moving water in rivers is used to rotate water turbines to generate hydroelectric energy.

Note:

In the previous activity, the water used to rotate the blades was not run out but renewed by filling the jug again ,which simulates what is happening on the Earth, where :
The river's water does not return back to its source on its way through the dam but it flows into other bodies of water, evaporates then condenses into clouds.
- When rain falls from these clouds, the water returns again to the river, and this is called the water cycle.



Exercises 1

(A) Choose the correct answer:

1. The solar panels use solar energy to generate .... energy that is used to light up lamps of light posts.

a. thermal b. kinetic

c. electrical d. light

2. All the following are considered as non-renewable energy resources except ....

a. coal. b. watermills.

c. natural gas. d. petrolum.

3. Windmill turbines generate electricity that can be used to operate all the following devices except ....

a. television. c. hair dryer.

b. blender. d. hand bell.

Give a reason for the following :

Modern watermills contain turbines.

....

....

(A) Put (√) or (×) :

1. Electricity that is produced from watermill turbines is considered as non-renewable energy resource. ( )

2. Some toy cars are operated by batteries that are considered as renewable energy resource. ( )

3. Hundreds of years ago, people used windmills to grind grain to make flour. ( )

What happens if ...?

The water supply that surrounds some modern watermills dries up.

....

....

Look at the figure, then complete the following sentences:



1. Device number (1) represents a .... which depends on the energy produced from the ....

2. The energy used to operate a device number1 is considered a .... energy resource.

3. Device number (2) produces.......... energy and ....energy.

Exercises 2

(A) Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Windmills |2. Solar panels 3. Watermills	a. generate electricity by using the kinetic energy running water. b. generate electricity by using sound energy. c. generate electricity by using solar energy. d. generate electricity by using the kinetic energy moving air.

1. .... 2 .... 3 ....

(B) Give a reason for the following :

You shouldn't look directly at the Sun.

....

....

(A) Correct the underlined words :

1. The stove uses natural gas which is considered as a <u>renewable</u> energy resource. (..................)

2. We can use <u>straight</u> mirrors to direct sunlight onto metal pots to heat them for cooking. (..................)

3. Windmill turbines convert kinetic energy into <u>light</u> energy. (..................)

(B) What happens if ... ?

Radiant energy that comes out of the Sun enters the greenhouses.

....

....

Look at the opposite picture, then complete the following sentences:

1. The name of this glass building is.................



2. The idea of working of this building depends on receiving the .... energy from the Sun.

3. The received energy is converted into .... energy that warms the interior of this building.

4. In the cold regions, this building allows farmers to plant crops that only grow in .... climates.

Exercises 3

(A) Complete the following sentences:

1. Radiant energy is used to generate electricity directly by using ...., or indirectly as it causes .... blowing that is used to rotate windmills.

2. A windmill spins faster by decreasing the number of its ....

3. The energy that is produced from modern wind turbines and old windmills is considered as .... energy resource.

(B) Give a reason for :

Farmers use greenhouses to plant crops that grow in warm climates.

....

....

(A) Put (√) or (×) :

1. Solar panels are used to generate sound energy in light posts. ( )

2. When the kinetic energy that is applied to the wind turbines increases, they produce more electricity. ( )

3. Both solar panels and natural gas are from renewable energy resources. ( )

What happens if ... ?

The number of windmill blades increases.

....

....

If the two windmills in front of you are affected by the same wind force.

Answer the following questions :



Windmill (A)



Windmill (B)

1. Which windmill spins faster? (Give a reason for your answer).

....

....

2. Which windmill generates less electrical energy?

....

....

Exercises 4

(A) Choose the correct answer:

1. When the wind turbine rotates, the energy of moving air changes into .... energy.

a. electrical — b. light

c. chemical — d. potential

2. All the following can be done by the effect of solar energy except....................

a. warming houses.

b. cooking food.

c. producing sound from a hand bell

d. producing light from a light post.

3. Water turbines can generate more electricity by increasing the .... energy of water that is stored in dams.

a. light — b. sound

c. thermal — d. potential

(B) Give a reason for the following :

Water turbines are used to generate electricity in dams.

....

....

(A) write the scientific term of each of the following:

1. A building that is built across rivers to control the water flow and increase its potential energy. (.......................)

2. A building that is used in cold areas to plant crops which grow in warm climate. (.......................)

3. An energy that is produced from water turbines and is transmitted through wires to operate different devices in houses. (.......................)

B) Mention two devices use solar energy to be operated then mention the energy transformation in each one of them.

1. Device (1) :...

Changes of energy :...

2. Device (2) :..

Changes of energy :..

Look at this picture that shows the High Dam that was built in Aswan many years ago, then put (√) or (×) in front of the following questions:



1. Stored water behind this dam has potential energy. (   )

2. The flow of water through this dam can be controlled. (   )

3. When water is released, it flows through wind turbines in the dam. (   )

4. When turbines rotate in the dam, an electrical energy is generated. (   )

Exercises 5

(A) Correct the underlined words:

1. The energy that is produced by <u>wind</u> turbines is called hydroelectric energy. (.................)

2. Wind turbines produce more electricity when the wind blows from the <u>front</u> of its blades. (.................)

3. Greenhouses convert radiant energy that is come from the Sun into <u>light</u> energy that is used to plant crops which grow in warm climates. (.................)

(B) What happens if ..?

The number of wind turbine blades decreases.

....

....

(A) Cross out the odd word :

1. Water - Wind - Coal - Sun. (.................)

2. Solar car - Hand mixer - Solar panel - Greenhouse. (............)

3. Gasoline - Coal - Natural gas - Windmill. (.................)

(B) Compare between water turbines and solar panels in the table below :

P.O.C	Water turbines	Solar panels
1. Source of energy that is used to operate it:	....	....
2. The produced energy :	.... energ	.... energy and .... energy.

3. Look at the figure, then put (√) or (×) :



1. Water in the area (A) can be used in rotating water turbines. (   )

2. Water in the area A has no kinetic energy. (   )

3. Water in the area B may evaporate in the presence of sunlight. (   )

4. When water evaporates in both areas A and B, it never return back to the river. (   )

Model Exam

(A) Write the scientific term of each of the following:

4 Main energy which is produced from both electric mixer and manual mixer. (.....................)

2. Huge bodies in the space made mostly of hydrogen and helium gases. (.....................)

3. A mill that uses the power of flowing air to generate electricity. (.....................)

4. A turbine in which the kinetic energy of moving water is used to generate hydroelectricity. (.....................)

(B) Give a reason for the following :

Dams are built on rivers.

....

....

(A) Correct the underlined words :

1. Thermal energy and sound energy are produced from the Sun and reach the Earth. (.....................)

2. When air blows into the wind turbine with a large force, the blades spin slower. (.....................)

3. Solar panels use <u>sound</u> energy to generate electricity. (.........)

4. During the flowing of river's water downhill, the <u>chemical</u> potential energy of water is converted into kinetic energy. (.....)

(8) What happens if ... ?

You look directly at the Sun.

....

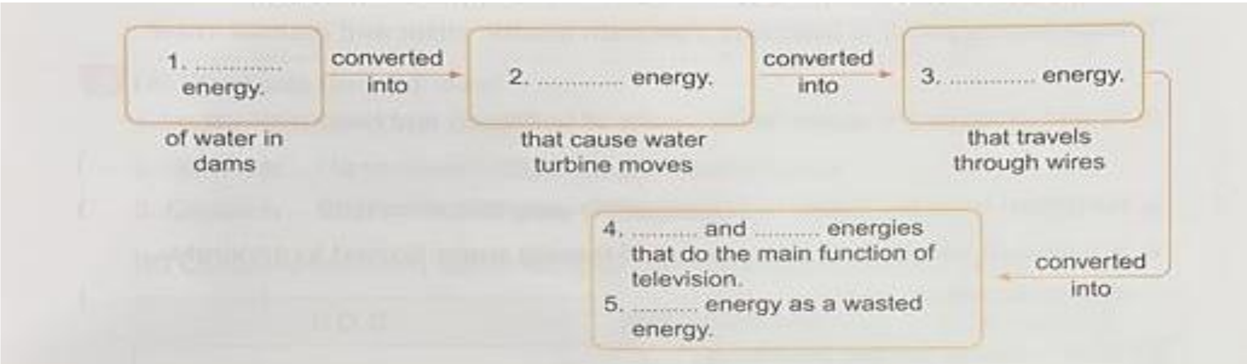
....

B (A) Put (√) or (×) :

1. Both wind movement and water flow has kinetic energy.( )
2. The Sun does not have a solid surface. ( )
3. Wind is a renewable energy resource. ( )
4. The flow of water can't be controlled to generate electricity in dams. ( )

(B) Complete the following energy chain of a television by using the words between brackets:

(Electrical - Sound - Thermal - Potential - Light - Kinetic)



(A) Choose the correct answer:

1. In the water cycle, water .... then it.............. before falling in the form of rains.

a. freezes - evaporates

b. evaporates - condenses

C. evaporates - freezes

d. condenses - evaporates

2. The solar energy is converted into .... energy in greenhouses.

a. electrical b. sound

c. thermal d. potential

3. The reason of flowing of river water downhill is the .... force

a. pushing b. friction

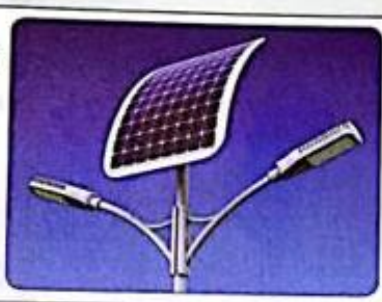
c. gravitational d. electrical

4. Some types of lamps depend on .... as a renewable energy resource in order to do its function.

a. sunlight b. petrol

c. coal d. natural gas

Compare the following table :

	Used energy	Produced energy
1. 	.... energy	Light energy and .... energy
2. 	Kinetic energy	.... energy
3. 	.... energy	.... energy